CALIFORNIA SALMONID STREAM HABITAT RESTORATION MANUAL

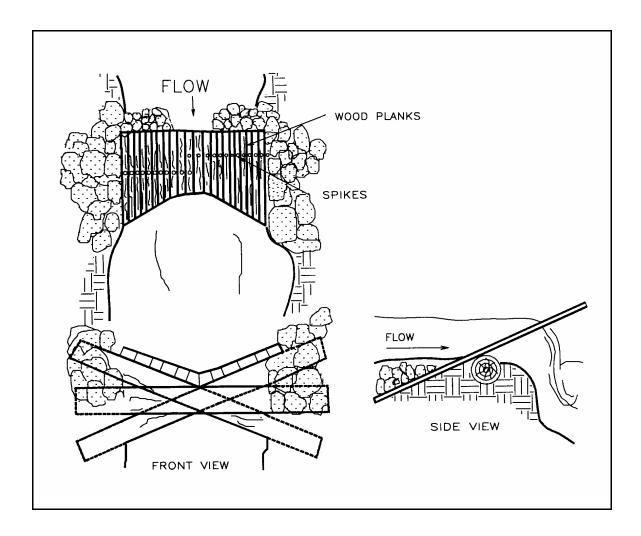


Figure VII-36. Hewitt ramp.

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Placement of Imported Spawning Gravel

In streams that are deficient in spawning gravel, either naturally or because of artificial structures which prevent gravel recruitment or transport, addition of spawning size gravel may be beneficial. Several techniques may be used.

Gravel may be placed upstream of weir installations to a depth of about 18 inches. Spawning gravel for salmon should be clean, creek-run from 2 inch to 4 inches in diameter. Gravel would normally be dumped at a staging area on the bank and then picked up and placed with a front-end loader or hydraulic excavator.

In some streams that have high levels of fine sediment transported at normal flows, or in many streams after a high flow or watershed disturbance, fine sediment may be deposited in spawning gravel substrates. Therefore, periodic maintenance might be required to reduce fine sediment in spawning areas. This usually is done by plowing the gravel with a ripper attachment on a tractor and adding fresh gravel. Ripping is also an excellent technique for improving quality of natural spawning riffles infiltrated by fine sediment. Watersheds that have high levels of fine sediment yield should be treated to control the sediment source, if possible, before gravel seeding is considered as a project.

Gravel may be spread on spawning riffles without control weirs. This normally is appropriate where a dam or other artificial structure has blocked natural downstream movement of gravel, and gravel from once-productive spawning riffles has been washed away. It may be advisable to scrape off some of the armoring layer of cobble before fresh gravel is added. This technique should only be used in reasonably stable riffle areas, or there is an unacceptable risk of having the eggs and gravel wash downstream with high flows after fish use the gravel for spawning.

Sometimes, spawning habitat can be improved by simply dumping gravel in an area of high water velocity and allowing the stream to distribute the gravel downstream during high flows. An area of active bank erosion is usually a good site for this technique because the stream has demonstrated the ability to move substrate material. The project may also provide temporary protection for the bank until the gravel is washed away.

Fish Screens

Unscreened water diversions have been recognized as a serious problem for California=s salmonid populations since the early 1900's. As a result, screens have been used to prevent entrainment of juvenile salmonids in water diverted for agriculture, power generations, or domestic use since the 1920's, and are needed on both gravity flow and pump diversion systems. Through the years, fish screen technology has improved dramatically, and high performance, low maintenance designs are now available. Screening criteria by DFG and NMFS (Appendix S) has established specifications which must be included in fish screen designs. This criteria requires water diversion screens to complete a barrier to salmonid entrainment.

Currently, most fish screens consist of perforated metal plate, or mesh material, with openings sized to prevent entrainment of juvenile salmonids. Screen systems that utilize light,

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electric fields, sonic systems, and bubble curtains as barriers have been tested, but are not adequate. Screens utilize debris cleaning devices, typically brushes, water jets, or compressed air to prevent them from plugging. Bypass routes return fish to the stream channel. Normally a flow measuring device and head gate are required to monitor and control diversion flows. Screen designs are complex and site specific, and many require professional engineering; therefore, none are included in this manual. Consultations with staff from DFG fish habitat improvement shops and NMFS are recommended to determine fish screen suitability at a proposed diversion site.

FISH PASSAGE

Obstructions to upstream migration frequently restrict distribution of salmonids. When barriers to fish movement exist, reaches downstream of the blockage may become overcrowded with spawners or juvenile fish, while suitable areas upstream lie unused. Even a partial obstruction, which only poses a barrier under certain flow conditions, can be a serious problem.

Increasing the use of spawning and nursery areas above natural and human-induced obstructions is a sound approach to restoration which has met with considerable success. A note of caution that must be included, however, is: avoid situations in which newly created access for one species results in competition with a species or population already established in the area above the obstruction. Possible species interactions might include steelhead versus non-anadromous rainbow trout, or coho salmon versus established populations of cutthroat or steelhead trout. Competition with the introduced species may reduce the population of the established species or population.

The key physical characteristics of the stream which inherently affect salmonid migration should be understood before any attempt is made to remove or modify an obstruction. Low waterfalls (less than six feet), cascades, and chutes in natural watercourses can affect fish migration in several ways. When water drops vertically into a pool of depth at least 1.25 times height of the drop, fish have very little difficulty jumping over a low obstruction. The upwelling water, or Astanding wave@ created by flow plunging into the pool will actually assist fish by imparting an upward force as a fish leaps from the pool. However, an incline or chute can form a hydraulic jump further downstream; encouraging fish to jump too far from the crest of the drop (Figure VII-37).

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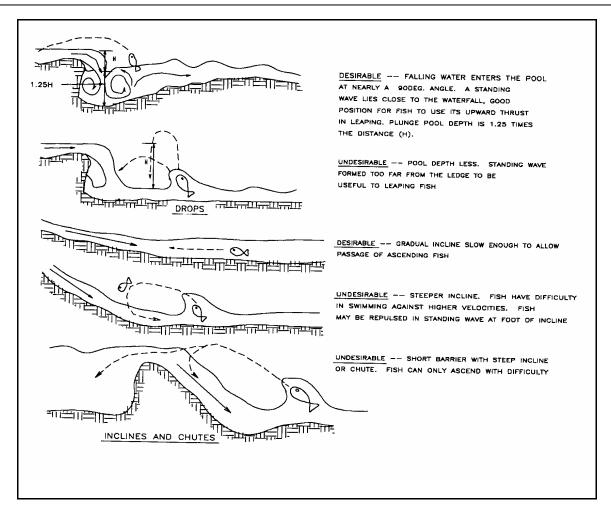


Figure VII-37. Movement of fish over natural obstacles (*Stream Enhancement Guide*, British Columbia Ministry of Environment, 1980, p. 27).

Obstructions

Natural obstructions to fish movement include waterfalls, chutes, logs and debris accumulations, and beaver dams. Any of these can create total or selective barriers. Often these barriers can be modified to provide fish passage, but regarding both log jams and beaver dams, care must be taken to preserve their rearing habitat benefits as well as to provide upstream passage. Removal of any natural obstruction during salmonid egg incubation may cause loss of the redd through silt deposition or changes in flow characteristics. Except for emergencies, any work to remove natural obstructions should be completed during low-flow periods outside the spawning or incubation season.